REMARKS

In the Action, claims 5-7 and 19-24 are rejected. In response, claim 19 is amended. In view of these amendments and the following comments, reconsideration and allowance are requested.

The Rejections

The claims are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Claim 19 is amended to refer to a base paper and to the amount of starch being less than 2 parts by weight. These amendments are submitted to overcome the rejections under 35 U.S.C. § 112.

Claim 5 is rejected for the position that the specification does not support the claim reciting a gate roll coater. Applicants respectfully submit that the transfer roll coater disclosed on page 13 of the specification is inherently a gate roll coater and that the specification as a whole teaches to one skilled in the art the use of a gate roll coater. As noted in the Action, page 12, lines 12-16 of the specification reference gate roll coaters for precoating base papers. Thus, one skilled in the art would recognize that a gate roll coater can be used for applying the coating color as in the present invention.

As noted in the previous response, the transfer roller disclosed on page 13 of the specification is inherently a gate roll coater. The Action indicates that there is no showing that gate roll coaters must have inner and outer gate rolls of the same size. Enclosed is a copy of the relevant pages from the 1996 TAPPI Proceedings. Figures 7 and 8 on page 81 show gate roll coaters which are able to apply the coating at a speed of 1000 mpm. It is unnecessary for a gate roll coater to have the inner and outer gate roll of the same size because the inner and outer gate rolls have different roles and functions in the coating process. As disclosed on page 173 of the attached article, the difficulties in applying starch

solutions using gate roll coaters is discussed. Furthermore, this passage discloses that in applying a coating film with gate roll coaters, the first set of rolls determine the feeding film thickness and the second set controls the film uniformity. Thus, the rolls in the gate roll coater provide a different function so that it is not necessary that the inner and outer rolls be of the same size.

Accordingly, Applicants respectfully submit that the specification supports the gate roll coater of claim 5.

Claims 19-23 are rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 6,197,155 to Wurster et al. Wurster et al. does not disclose the combination of the steps for producing the coated paper for a web offset printing. Wurster et al. does not disclose applying a coating color to a base paper by a film transfer method using a roll coater at a weight of at least 7 g/m^2 where the coating color comprises about 5 to 50 parts by weight of an adhesive, an auxiliary consisting essentially of polyvinyl alcohol in an amount of 0.1 to 1.0 parts by weight and starch in an amount of less than 2.0 parts by weight as in the claimed invention.

Wurster et al. refers generally to the binder composition which can contain various components in various amounts. Wurster et al. does not reasonably suggest to one skilled in the art a coating color containing 5 to 50 parts by weight of an adhesive and about 0.1 to 1.0 parts by weight of an auxiliary consisting essentially of polyvinyl alcohol. Based on the disclosure of Wurster et al., Wurster et al. uses higher amounts of polyvinyl alcohol in combination with a synthetic binder as the binder component. Wurster et al. also does not disclose starch in an amount of less than 2.0 parts by weight in addition to the adhesive and the auxiliary component as in the claimed invention. Thus, claim 19 is not obvious over Wurster et al.

The depending claims are also not obvious as depending from claim 19 and for reciting additional features of the invention. Wurster et al. does not disclose the total amount of adhesive as in claim 20, the starch as in claim 21, or the adhesive of claim 22, or the solid content of claim 23, in combination with the features of claim 19.

Claim 24 is rejected under 35 U.S.C. § 103(a) as being obvious over Wurster et al. in view of JP 11-050392. As noted in the Action, Wurster et al. does not disclose a transfer roller having an inner roll, an outer roll, and an applicator roll, a coating speed of 1100 m/min or more, and a peripheral speed of the inner and outer roller of the applicator roll being 50 to 95%.

JP '392 does not suggest to one of ordinary skill in the art the claimed method of applying the coating color in the manner of claim 24. JP '392 specifically discloses a starch content of 15 to 35 parts by weight based on 100 parts by weight of the pigment. In contrast, the starch in the claimed invention is less than 2 parts by weight based on 100 parts by weight of the pigment. As disclosed in paragraph 0010 of JP '392, the process is specifically disclosed as requiring 15 parts by weight or more of a starch based on 100 parts by weight of the pigment to avoid the difficulties encountered with dry strength and vessel pickup. This passage disclosed the problems associated with high speed application, but does not provide a solution to avoiding these difficulties.

On the other hand, the claimed invention is directed to the use of a small amount of starch, namely, less than 2.0 parts by weight, to improve the transferability of the coating color by a gate roll coater and to attain high coating weight and good ink density as disclosed on page 8, lines 20-25 of the specification. The coating color as defined in claim 19 also provides the coated paper with blister resistance as disclosed on page 25, line 10, avoids boiling or misting during the coating step as disclosed on page 9, lines 10-17, the high speed coating runability is improved as disclosed on page 13, lines 9-12, and produces a coated

paper suitable for web offset printing. JP '392 provides a high starch content, and thus, does not provide the same solution to avoiding the problems associated with coating as in the claimed invention. Accordingly, it would not have been obvious to one skilled in the art to select the gate roll coater disclosed in JP '392 for use with the composition disclosed in Wurster et al. One skilled in the art would not reasonably expect the gate roll coater of JP '392 to provide the advantages of the claimed invention by using the composition of Wurster et al. One skilled in the art would not have a reasonable expectation of success of reducing misting and boiling by using the roll coater of JP '392 with the composition of Wurster et al. Accordingly, claim 24 is not obvious over the combination of Wurster et al. and JP '392.

Claims 5-7 are rejected under 35 U.S.C. § 103(a) as being obvious over Wurster et al. in view of U.S. Patent No. 5,972,168 to Hayasaka et al. and JP '392. Wurster et al. is cited for the reasons discussed in connection with claim 19. Hayasaka et al. is cited for disclosing the use of a transfer roll coating process to apply a coating color using a metering size press coater and gate roll coater. JP '392 is also cited for disclosing the use of a gate roll coater.

The combination of the cited patents does not render the claimed invention obvious to one of ordinary skill in the art to produce a coated paper with the claimed coating color applied by a gate roll coater at a coating speed of 1100 m/min or more with a peripheral speed ratio of the inner roll and the outer roll to the applicator roll being 50 to 95%. Applicants discovered that the use of the combination of polyvinyl alcohol and starch in the claimed amounts provide advantageous effects that are not disclosed or suggested in the art of record. Pages 6 and 7 of the specification disclose the coating color containing polyvinyl alcohol and starch in the claimed amounts to provide good runability and excellent printability and blister resistance for web offset printing. Blistering, misting and splashing or boiling are common problems at high speed coating as a result of the continuous rotation of the inner and outer roll.

Applicants have found that high speed coating at a coating speed of 1100 m/min or more can be obtained using a coating color containing small amounts of polyvinyl alcohol and less than 2.0 parts by weight starch. Applicants have found that polyvinyl alcohol in amounts greater than 2 parts by weight increase the coating viscosity to an unacceptable level for high speed coating. The prior process require lowering the solid content of the coating color to lower the viscosity. Increasing the coating weight of a low density coating color by a transfer coating process requires the absolute weight of the coating color on the applicator roll to be increased. A low solids coating color at an increased coating weight on the applicator roll results in scattering and misting of the coating color on the roller.

Wurster et al. does not suggest to one skilled in the art a coating color having a composition capable of being applied at a coating speed of 1100 m/min or more as in the claimed invention. Wurster et al. refers only to a coating speed of a Massey coater which operates at lower speeds such as 600 m/min. It would not have been obvious to one skilled in the art based on the teachings of Wurster et al. to operate the coating device at a speed of 1100 m/min or more as in the claimed invention. One skilled in the art would expect the coating color composition disclosed in Wurster et al. to exhibit significant boiling or misting. Applicants have found that a coating color containing a pigment and an adhesive where the coating color contains 0.1 to 1.0 parts by weight polyvinyl alcohol as an auxiliary and a starch in an amount of less than 2.0 parts by weight in a combination with the adhesive provide a composition that is able to overcome the disadvantages of Wurster et al. without reducing the coating weight and which can be applied at a coating speed of 1100 m/min or more. The coating color as in the claimed invention when applied by the coater at the claimed coating speed minimizes misting and boiling without increasing the absolute coating weight. These features would not have been obvious to one skilled in the art based on the disclosure of Wurster et al. either alone or in combination with Hayasaka et al. and JP '392.

The coating color of the invention avoids the misting and boiling at high coating speeds of 1100 m/min or more as disclosed on page 13, lines 9-12 of the specification. The high coating speeds are attained under a peripheral speed ratio of the inner and outer roll to the applicator roll of 50 to 95% using the claimed coating color containing 0.1 to 1.0 parts by weight polyvinyl alcohol and less than 2.0 parts by weight of a starch. Wurster et al., JP '392 and Hayasaka et al. do not provide the technical teachings to overcome the problems associated with blistering, misting or boiling.

Hayasaka et al. and JP '392 do not render the claimed invention obvious to one skilled in the art when viewed in combination with Wurster et al. Hayasaka et al. does not disclose the use of polyvinyl alcohol as an auxiliary in a coating color in the claimed amounts of the present invention. Hayasaka et al. discloses a starch latex copolymer as a binder in an amount of 20 to 50 wt% based on the weight of the pigment, and thus, is an example of the prior coating colors that use a high amount of starch. In the present invention, Applicants have discovered that small amounts of starch, namely, not more than 2 parts by weight of starch, provide improved application of the coating color at high speed. Applicants found that starch in amounts greater than 2 parts by weight, and particularly starch in the amounts disclosed in Hayasaka et al. are not suitable for web offset printing because of the high resistance to air permeation and low blister resistance. Thus, Hayasaka et al. is specifically directed to a coating color having a high starch content such that it would not have been obvious to one skilled in the art to combine the teachings of Hayasaka et al. with Wurster et al. Furthermore, it would not have been obvious to one skilled in the art to apply the coating color of Wurster et al. using the coating device of Hayasaka et al. since Hayasaka et al. teaches that high amounts of starch are needed to apply the coating color using the apparatus disclosed in Hayasaka et al. Thus, it would not have been obvious to one skilled in the art to apply the coating color of Wurster et al. by the method disclosed in Hayasaka et al.

JP ‘392 also does not suggest to one skilled in the art that it would have been obvious to apply the coating color of Wurster et al. using the gate roll coater of JP ‘392. JP ‘392 only discloses a liquid coating containing a starch or derivative in an amount of 15 to 35 parts by weight. Thus, JP ‘392 is similar to Hayasaka et al. in specifically disclosing high amounts of starch in the coating color when applied by a gate roll coater. JP ‘392 provides no suggestion to one skilled in the art that a coating color containing less than the amount of starch disclosed in JP ‘392 can be applied using a gate roll coater at high coating speeds. JP ‘392 specifically teaches to one skilled in the art that high starch contents are necessary for use in a gate roll coater. In contrast, Applicants have discovered that small amounts of starch, namely, less than 2.0 parts by weight of starch and 0.1 to 1.0 parts by weight polyvinyl alcohol in a coating color can be applied at a coating speed of 1100 m/min or more and at a peripheral speed ratio of the inner and outer roll of 50 to 95% as in the claimed invention. It would not have been obvious to one skilled in the art based on the teachings of Wurster et al., Hayasaka et al. and JP ‘392 to apply the coating color of Wurster et al. using a gate roll coater at the claimed coating speeds. Based on the disclosure of these patents, one skilled in the art would expect the coating color to exhibit significant boiling, misting and blistering. Therefore, when viewed as a whole, the claimed invention is not obvious over the combination of these cited patents.

The cited patents also do not disclose the coating color containing 18 parts by weight or less of an adhesive as in claim 6, the coating color being applied at a coating rate of 7 g/m^2 or more as in claim 7, in combination with the steps of claim 5. Accordingly, these claims are also not obvious to one skilled in the art over the combination of the cited patents.

In view of these amendments and the above comments, reconsideration and allowance are requested.

Respectfully submitted,

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PROCEEDINGS

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Metered Size Press Forum Proceedings

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One metering method that has maintained popularity is the gate roll transfer system, Figure 7. The gate roll has become the primary metering method for surface treated Newsprint. The process is used to apply .25 to .3 gms total starch pickup at 3 to 7% solids with machine speeds up to 1500 mpm. Film thicknesses associated with these application rates are 2.5 to 5.0 microns (0.1 to 0.2 mils). Uniform thin film application is the primary advantage of the gate roll transfer system.

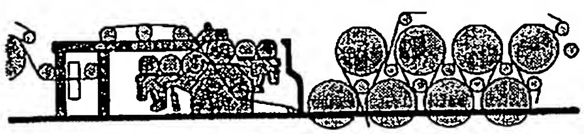

Figure 7. Gate Roll Size Press on Newsprint

Gate roll transfer technology is also being used to apply pigments as precoaters and as base coat applicators for printing and writing grades. Operations range from 4 to 10 gms per side at 50 to 65% solids with speeds ranging from 500 to 1200 mpm, Figure 8.

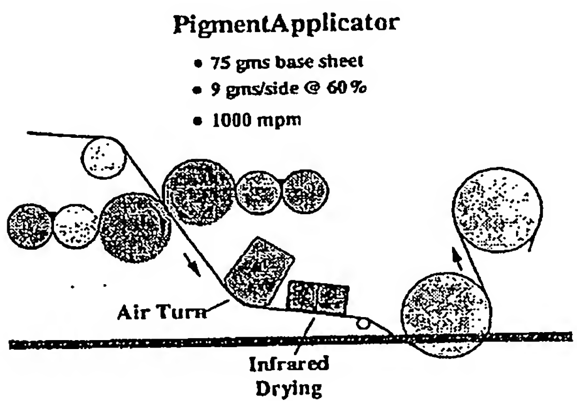

Figure 8. Gate Roll Size Press

Advancements in gate roll technology designed to optimize quality include roll design, roll covers, cover finishes and roll cooling systems. Large diameter rolls are used to reduce pond turbulence and tight roll balancing specifications provide stable operation. New roll covers, both rubber and polyurethane, improve wear and overall life. Textured rolls are used to promote uniform, very thin film application. Improved roll cooling systems provide uniform CD temperature profiles.

Although the gate roll film coating process is a viable solution in some markets and/or for some machines, there are concerns associated with gate roll metering as machine speeds increase. Inherent to a puddle of starch or coating are non-uniformities such as turbulence, nip rejection and wringing patterns. Coating solids, viscosity and machine speed are all factors influencing the severity of nonuniformity that could be transferred to the sheet. These concerns have driven further development of film transfer beyond gate roll technology.

Today there are several metering methods being used in the metering size press application to apply coating in a wide range of film thicknesses. Figure 9 shows typical metering elements used on a conventional metering size press for both starch and pigment

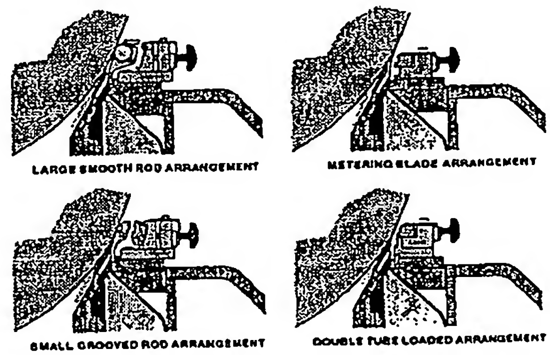

Figure 9. MSP Metering Elements

applications. In this case, the coating is applied through a metering head and is metered to the desired film thickness. Metering is accomplished hydrodynamically using smooth rods and bent blades or volumetrically using grooved rods. Each metering element offers flexibility and control of the final film thickness.

Film Applicators	*Application*	*Film Thickness (microns)*
Gate Roll Press	Starch	2.5 - 5.0
Metering Size Press		
Single Tube Blade	Starch	12 - 30
Grooved Rod	Starch	9 - 25
Gate Roll Coater	Pigment	2.5 - 15
Metering Size Press		
Double Tube Blade	Pigment	5 - 30
Smooth Rod	Pigment	5 - 20
Metering Roll Coater	Starch & Pigment	2.5 - 30

Figure 10. Film Thickness Comparison

Figure 10 describes the flexibility of today's film applicators. One thing to note is that the elements are capable of a wide range of film thicknesses. To maintain MD and CMD film uniformity through these application ranges, the roll cover material, finish, hardness and loading conditions between the metering element and roll must be optimized.

For example, in Figure 3, a film coater designed to apply 8 gms per side would require between 63 and 69% solids coating formulation to maintain similar wet strength. Or as shown, a 65% formulation would provide sufficient wet strength.

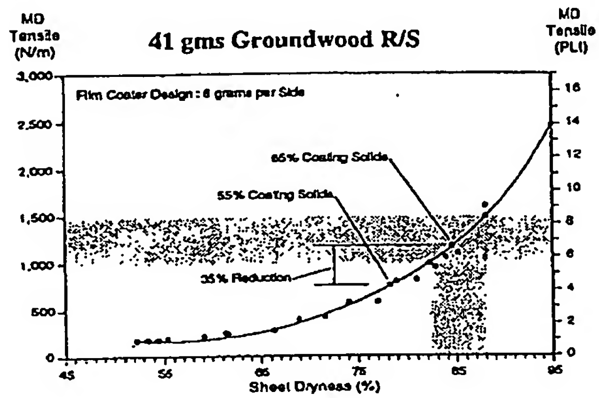

Figure 3. Re-Wet Tensile Strength

However, 55% coating solids at 8 gms per side relates to a 78.5% sheet dryness out of the coater. In this case, the wet strength is approximately 700 N/m (4.1 PLI) or a 35% reduction on the average in tensile strength.

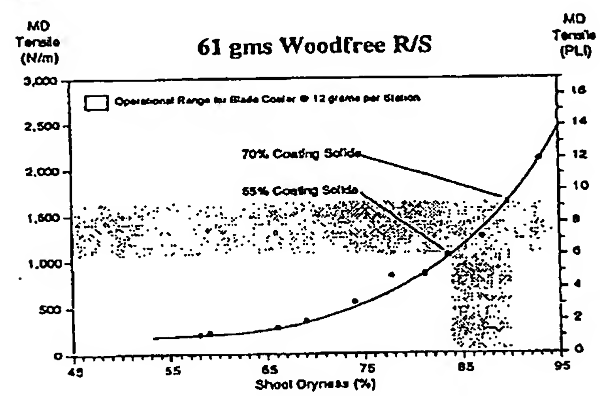

Figure 4. Re-Wet Tensile Strength

Figure 4 illustrates similar relationships for a 61 gms Woodfree rawstock. Notice that the typical application of 12 gms per side at 55 to 70% solids relates to a wet strength of 1050 to 1620 N/m (6.0 to 9.2 PLI). For the film coater, 12 gms per side would require 65% coating solids minimum to maintain the wet strength of conventional blade operations, Figure 5. However, 9 gms per side at 62% solids would provide a more suitable tensile strength compared to conventional blade coater operations.

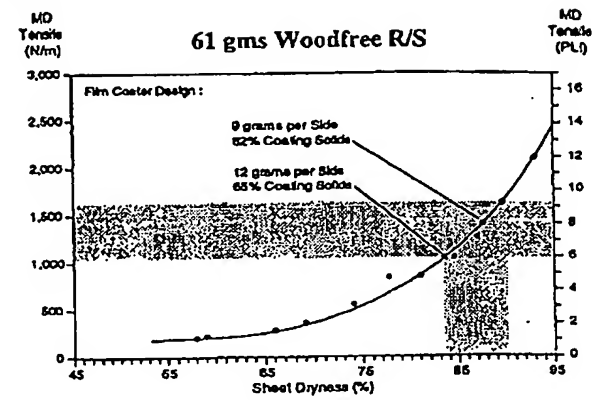

Figure 5. Wet Tensile Strength

For both Woodfree and Groundwood grades, the film coating process requires relatively high solids coating formulations to maintain similar re-wet tensile strength values that are defined by blade coater runnability. For equal wet tensile values, film coaters will have better efficiency, less stress on the web.

The next step would be to apply the associated water load to a drying process. Figure 6 illustrates a Metering Size Press designed for 8 gms per side at 60% solids and 1200 mpm. This

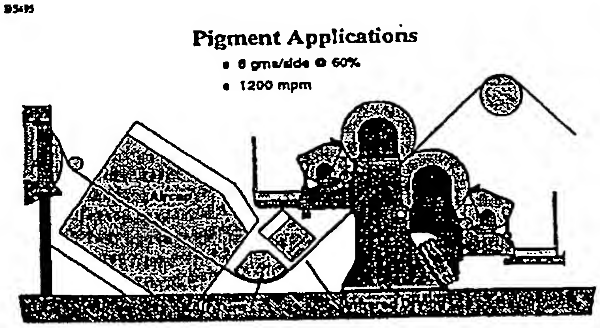

Figure 6. Metering Size Press

arrangement is running on a woodfree sheet producing a #3 grade and is followed by an OMC for double coated premium grades. As you can see the coating solids are 60% due to the low total coat weight. In this case the smooth rod metering element is used to hydrodynamically transfer the coating film to the applicator roll.

Non-contact drying is accomplished with a combination of Infrared and Flotation air. As with blade coaters, the wet coating film must reach immobilization before cylinder drying. For the C2S film coated sheet, water is available for drying from both sides of the sheet so evaporation rates are higher than for blade coaters.

Applied Coating Film Uniformity

The second film coating challenge is to transfer a uniform coating film to the applicator roll and finally to the passing web.

RHEOLOGICAL ISSUES IN CONVENTIONAL SIZE PRESS OPERATIONS

Conventional size press operations include any roll-type equipment used for transferring surface treatment onto paper. The majority include forward roll size presses in either a vertical, horizontal, or inclined arrangement. Most of the application work, with these types of size presses, have involved coating polymeric solutions of natural or synthetic binders at relatively slow speeds. Dill *(2)* and Klass *(1)* review in detail the operational characteristics of these systems and the factors influencing pickup (coat weight). Pigmented coatings have only been applied on a limited basis with this type of equipment , but most often the solids concentrations have to be comparatively low, in the range of 20 to 40 percent, or the operational coating speeds need to be relatively low *(3)*. However, selected aspects of runnability and rheological requirements for roll size presses and coaters are relevant to metered size press applications with pigmented coatings and, therefore, are reviewed here.

In the conventional size press, the solution is delivered to the nip between two oppositely rotating rolls and forms an open pond of material above the nip which feeds the flow (Fig. 1). The applied sizing solution or coating absorbs the kinetic energy from the roll rotation and the web movement. The nip between the two rolls restricts the flow and meters the amount of sizing or coating that is added to the paper. In that sense the fluid dynamics of this process are similar to those in forward roll coating and roll-over-plate flows. A film-splitting meniscus occurs at the point where the film is split between the paper and the rolls (Fig. 1). The film thicknesses in Fig. 1 have been exaggerated to show details. In reality the thickness of the film applied on to paper is much smaller than shown. When the operational speed increases, inertia forces in the feeding pond become large enough so that a backflow develops, which causes coating fluid to be rejected. If the back flow rate becomes high enough the surface of the coating in the pond will be broken and coating splashes out of the nip. It is uncertain if the phenomenon is due to the high-intensity recirculating vortices appearing in the pond or to the unstable dynamic contact line between the coating and air, but "nip rejection" causes uneven pickup of the wet film across the machine and limits the operational window of this type of equipment *(1,4)*. Additionally, film splitting patterns occur well before the onset of splashing and influence the uniformity of the film deposited onto the paper. Mill experience demonstrates that, at speeds above about 700 m/min, the fluid velocities become great enough for the surface of the pond to be broken, resulting in splashing and uneven starch pickup *(5)*. Therefore, conventional roll-type size press equipment is limited with respect to speed of application.

Conventional size press pickup and coat weight depend on various factors including properties of the basesheet and coating, as well as operational machine variables *(1,2,6,7)*. Basesheet properties include: absorbency, porosity, internal sizing, and moisture content. Coating parameters comprise viscosity, solids content, and temperature. Size press parameters such as speed, pond depth, nip pressure and width are also important. Typically, the pickup is limited to about 20% of the weight of basesheet *(8)*. For pure starch solutions, pick up decreases with increased internal (acid) sizing levels, reduced sheet porosity and reduced sheet moisture *(2)*. Perry *(6)* reported that a sheet moisture content of 1-2% repels the coating and little or no coating is being applied to the surface. Drying to a 1-2% moisture level also keeps the sizing agent closer to the surface *(1)*. For pigmented coatings, moisture contents within the range 7-8% by weight give maximum pickup *(3)*. At higher levels of moisture, "bagging" (or cockling) and puckering occurs if the sheets are not handled carefully in the drying stage. Drying may not only be energy inefficient, but it may also limit the effective machine speed *(1)*.

The role of size solution viscosity is variable, depending on machine speed and pickup. Viscosity is proportional to solids and molecular weight of the soluble polymer (i.e., starch). For a constant low viscosity starch solution, pickup decreases with increasing speed, while at a high viscosity, pickup increases with speed *(2)*. Such behavior can be associated with pressure penetration of the sizing solution into the basesheet at the nip between the two rolls of the size press. Penetration, and therefore pickup, is problematic at high speeds and high solution viscosities due to patterning. As a matter of fact, low viscosities are required to be able to run at high speeds, i.e., above 300 m/min. Klass *(1)* notes that of the factors affecting pickup, solution viscosity and solids contents are the easiest to manipulate. However, adjusting coating color solids is not an effective tool to control coat weight in a mill setting. Additionally, the

solids are typically maintained at the highest possible level to minimize the amount of water that must eventually be removed from the paper.

At speeds below approximately 300 m/min (about 1000 ft/min), the Hercules® high-shear viscosity and the leveling index adequately define runnability. The leveling index is the ratio of the degree of thixotropic breakdown to the high-shear viscosity. Thixotropic breakdown represents the reduction of viscosity with time when a material is being sheared. It is proportional to the area of the loop in a rheogram with increasing and decreasing shear rate curves. Details of its calculation from Hercules® rheograms and examples are given in the papers by , Trelfa and Ware *(9)*, Lettenberger *(10)*, and Oakleaf and Janes *(11)*. A high leveling index value is being obtained if the thixotropic breakdown of the coating is high and the high-shear viscosity is low.

Two primary problems identified by Smith, Trelfa and Ware *(9)* with roll coating of 50-62% solids coatings at less than 300 m/min were (a) incomplete transfer from the applicator roll to the paper and (b) appearance of a residual surface pattern (i.e., orange peel) left on the paper when the coating separated from the applicator roll. The maximum coat weight that could be applied is a function of the shear dependent viscosity and therefore the coating solids; at a given machine setting a satisfactory 14 pounds coating could be achieved at 62% solids, while a 4 pounds coating could be achieved at 52% solids. While at low coat weights there was only partial coverage of the paper, at high coat weights there was a limit above which a "grainy" or moiré pattern would appear, also known as the orange peel pattern.

Coating rheology influences the attainable weights which are free of the pattern. Characteristically, a high level of thixotropy (i.e., significant reduction in viscosity with shear and time or a "wider" thixotropic loop in a Hercules® rheogram) and shear-thinning are desirable to avoid occurrence of the pattern at low speeds. Coatings with a poor performance are characterized by small amounts of thixotropy, high high-shear viscosity and a tendency toward dilatancy. It is noteworthy that although at low shear rates the up curve of a rheogram frequently shows an apparent dilatancy effect, rheology does not become problematic if the phenomenon disappears at higher shear rates. Smith, Trelfa and Ware *(9)* concluded that if a coating has high enough solids to permit efficient drying, but low enough to avoid dilatant effects, then the amount of shear thixotropy per unit viscosity, the leveling index measured at greater than 4000 s^{-1}, is a direct measure of the coating's patterning tendency. Characteristic rheograms are presented in Fig. 2. Two cases with a high and low leveling indexes are shown. The numerical value of the leveling index is the ration of thixotropy to high-shear viscosity; the thixotropy (width between the curves) being in the numerator and the viscosity (seen as torque) being in the denominator. For the example shown here, the higher leveling index is a result of the lower high-shear viscosity value at the maximum RPM. It is also possible to increase the leveling index by making the thixotropic loop area larger. For the dilatant coating, torque increases dramatically as the RPM is increased and no thixotropic loop is possible. Because the viscosity increases quickly to attain very large values, the leveling index of dilatant materials will be very small.

Similar results were reported by Lettenberger *(10)* for applying starch solutions in gate-roll coaters. In this application the coating film is being premetered with rolls (Fig. 3). The first set of rolls determines the feeding film thickness, while the second set controls the film uniformity. Although relatively high low-shear viscosities are required for pickup (i.e., 1500 mPa s @ 10 rpm Brookfield), the starch solution has to be shear-thinning and thixotropic to avoid patterning. In that sense, a leveling index of less than 0.20 to 0.25 is judged inoperable; 0.20 to 0.35 is borderline; and values above 0.35 is where operability is expected. Modified starches which reduce the high-shear viscosity and have a high degree of thixotropy are therefore preferable for roll coating. The same guideline was proposed by Oakleaf and Janes *(11)* who studied pigmented coatings applied at 61 m/min (200 ft/min) in a traditional size press. The finest size press patterns were obtained with pseudoplastic-thixotropic coating formulations. Table 1 shows the six factors that these authors found to be related to the size press pattern at a 99% confidence level. They reported that a multiple a regression showed that 87.2% of the variation in the size press pattern was predictable by the leveling index. At the low speeds of this work, the coating film-split pattern was reported to reduce as coating solids increased in the range of 30 to 55 percent or as the binder level was increased from 11 to 20 pph. All-latex coatings gave patterns with wider ribs than coatings with starch. While Oakleaf and Janes